

CLAIMS

What is claimed is:

1. A process for forming bonded cellulosic microfibers nonwovens comprises the steps of
 - (a) extruding a cellulose solution (dope) through a concentric melt blown spinneret with a plurality of spinning nozzles,
 - (b) drawing each individual extrudate filament to fine fiber diameter by its own air jet,
 - (c) coagulating and entangling the fine fibers with a series of pressured hydro needling jets of recycling solution of the mixture of cellulose solvent and non-solvent in the spin-line,
 - (d) collecting the stream of microfibers, air and needling jets on a moving collecting surface to form cellulosic fiber web,
 - (e) hydro-entangling the said pre-bonded web downstream with at least one set of hydro needling jets of recycling solvent/non-solvent solution for forming well bonded nonwoven web,
 - (f) regenerating the fine fibers in at least one bath for at least 5 seconds,
 - (g) further regenerating and washing the fine fibers in another bath for at least 5 seconds,
 - (h) pinching the well bonded melt blown cellulosic nonwoven with pressure rollers to remove major portions of the non-solvent.
 - (i) drying the nonwoven web by heat, or vacuum or both, and
 - (j) winding the nonwoven web into rolls.
2. The process of claim 1 in which the spinning nozzles are arranged in at least one row with a nozzle-to-nozzle space of 0.050" to 1.000"
3. The process of claim 1 in which the spinning nozzles are 0.005" to 0.050" in inside diameter and 0.500" to 3.000" in length.
4. The process of claim 1 in which the spinning nozzles are concentric with their individual gas holes and protruded -0.005" to 0.800" from the top plate of the said gas holes.

5. The process of claim 1 in which the solvent of the cellulose solution is one or more of the following: NMMO, dilute caustic soda, phosphoric acid, mixture of liquid ammonia/ammonia thiocyanate and others.
6. The process of claim 1 in which the non-solvent of cellulose is one or more of the following: water, alcohol ($C_nH_{2n+1}OH$, $n \leq 10$), and/or water/alcohol/solvent solutions
7. The process of claim 1 in which the recycling solvent/non-solvent solution is filtered and supplied from the regenerating bath by a high pressure pump and part of the solution is continuously removed from the said bath for solvent recycling.
8. The process of claim 1 in which the recycling NMMO solution is supplied to the needling jets from and come back to the first regenerating bath. The second washing bath is continuously filled with fresh non-solvent, which is sprayed onto the nonwoven web first. Part of the low concentration solution continuously overflow from the washing bath to the regenerating bath.
9. The collecting system for manufacturing the said cellulose fiber nonwoven comprises
 - (a) a paternally perforated drum with a diameter ranged from 20 inch to 70 inch
 - (b) at least one set of coagulating hydro needling jets, which contacts with flying fibers 0.5 inch to 30 inch from the collecting surface and at an angle from 5 degree to 75 degree (relative to the air blowing direction)
 - (c) at least another set of hydro needling jets downstream for both hydro-entangling and fiber regenerating.
 - (d) at least one regenerating bath and one washing bath with conveying belts.
 - (e) at least one vacuum section across and beneath the drum surface
 - (f) at least one heating section across and above the drum surface
10. The collecting system of claim 4 in which the regenerating and washing bathes contain series of rollers to guide the nonwoven web.
11. The conveying belt of claim 9 submerged in both bathes moves slower than surface speed of the collecting drum.

12. The cellulosic nonwovens of claim 1 in which the fibers are essentially continuous with an average size of 1 to 30 micrometer in diameter and bonded by both self-bonding and hydro-entanglement.